

Use of Thrombectomy in the Treatment of Acute Iliofemoral Venous Thrombosis in Forty-five Patients *

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THROMBECTOMY has been the treatment of choice for acute iliofemoral venous thrombosis in the University of Louisville Hospitals since December, 1959. Two years before,† Mahorner presented his experience with attempted thrombectomy for acute and chronic venous occlusion of the lower extremities.⁴ He suggested the usefulness of thrombectomy in preventing postphlebotic complications in patients with acute thrombosis thus reintroducing a concept which had lain dormant since its initial trials by Leriche in 1928.¹

There were two reasons for embarking upon a more aggressive therapeutic course. The first was a growing dissatisfaction with the prolonged morbidity of phlegmasia alba dolens when it was treated by conventional means. The second was a grave concern over the high incidence of *postphlebotic limb* which resulted from extensive deep thrombophlebitis. In a three-year period, 45 patients have undergone thrombectomy. All but one of the living patients have been seen within the last three months for follow up evaluation; 65 per cent of these have had postoperative phlebograms. An evaluation of the operative results in this

series of patients constitutes the purpose of this paper.

Indications

The single indication for thrombectomy in this series of patients was the diagnosis of acute iliofemoral venous occlusion in an otherwise healthy patient. No limitations were placed on this indication, such as the age of the patient, or the duration of symptoms.

The diagnosis of iliofemoral thrombosis can be made with certainty only when there is massive edema of the leg from toe to groin, with tenderness along the femoral canal. These findings are usually accompanied throughout the extremity by severe aching or throbbing pain which prevents the patient from standing or walking. These clinical features are distinctive and probably reflect a specific pattern of venous obstruction.² The *sine qua non* of iliofemoral thrombosis is uniform swelling of the extremity associated with tenderness over the femoral vein.

If the diagnosis cannot be made by clinical evaluation, then a phlebogram may be used to verify the presumptive diagnosis and to document the level of venous occlusion. Seventeen of our patients had preoperative phlebograms (Table 1). Most of these were carried out early in the study for verification of the diagnosis. It also seemed wise to record the extent of thrombosis before and after thrombectomy in a significant group of these patients. Phlebog-

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TABLE 1. *Thrombectomy for Iliofemoral Venous Thrombosis*

	Symptoms < 10 Days (Average = 2.8 days) (34 Patients)	Symptoms 14-21 Days (Average = 16.3 days) (11 Patients)
Preoperative phlebograms	10 (30%)	7 (64%)
Postoperative phlebograms	18 (58%)	4 (80%)
Operated < 6 months	3	1
Follow-up > 6 months	27	7
Lost to follow up	1	0
Dead	3	3
Total Follow up > 6 Months = 34/39 = 87%		
Average Follow up = 18.3 Months		

raphy proved to be a simple procedure and was not accompanied by complications in the pre- or postoperative studies.

Description of Operation

The surgical procedure of thrombectomy has been described in detail.³ The salient features of the operative attack are:

Moderate Sedation and Use of Local Anesthesia. Infiltration anesthesia with 1.0 per cent Xylocaine® was used in all patients. Most patients complained of discomfort when intravenous manipulations were carried out, but all were reassured by brief explanations as to the cause of their discomfort. Local anesthesia was considered mandatory to enable the patient to strain down during the extraction of the clot, to decrease the possibility of pulmonary embolization. In addition, it seemed worthwhile to avoid the possible complications of general anesthesia.

Adequate Exposure and Isolation of all Veins in the Femoral Canal. Boggy edematous tissues often contributed to poor exposure unless a generous six-inch incision was used. Umbilical tapes are vitally important around every venous tributary, especially the deep branches, if unnecessary blood loss is to be prevented after the thrombus is extracted.

Immediate Intravenous Heparinization when Clot is Identified Within the Vein. Before any manipulation of the clot, 25 to

50 mg. of heparin were given intravenously to prevent propagation of the thrombus during extraction and to avoid further thrombus formation after the clot was removed.

Meticulous Removal of all Available Thrombus Material Until Good Flow is Achieved in Both Directions. Unless all the clot is removed, the patient cannot be expected to achieve a maximum result. Until vigorous bidirectional bleeding occurs, this has not been accomplished, regardless of all explanation to the contrary.

Precise Hemostasis and Careful Reapproximation of the Wound Layers. With full anticoagulation exact hemostasis is imperative to avoid wound hematomas and the accompanying high incidence of infection which may cause rethrombosis.

Postoperative Care

All patients were maintained on oral anticoagulants for three weeks. No antibiotics were used. Active ambulation was begun on the fifth to seventh day. Elastic stockings were worn for six weeks and gradually discarded. The average hospital stay was 12 days.

Results

The 45 thrombectomy patients have been divided into two groups based upon the duration of their symptoms. This is not an arbitrary division for, as shown in Tables 2 and 3, there is a striking difference be-

tween the results obtained in patients operated upon within 10 days of the onset of their thrombosis and those whose occlusion was of 14 to 21 days' duration.

Thirty-four patients were operated upon in whom the symptoms were of less than 10 days' duration (Table 2). The majority were operated upon within a few days of the onset of their thrombosis. This is reflected in the average delay following onset of symptoms of 2.8 days. Extraction of the clot was generally very easy in this group. In 31 of the 34 patients, excellent flow was obtained in both directions. Twenty-six of these patients have apparently normal limbs and five have only slight to moderate disability. None of the patients has a postphlebitic limb and none required an amputation. Two of the three patients in whom poor flow was obtained at the time of operation have moderate disability with some residual edema. Three patients died of unrelated diseases (pelvic cancer, eight days postoperatively; cerebral vascular accident, 20 days postoperatively; perforated carcinoma of the colon, 17 days postoperatively).

Thirteen of the 26 patients with apparently normal limbs have had postoperative phlebograms of which 11 show normal patency of the deep venous system and two show major venous obstruction with extensive collateral circulation. Three of the five patients with slight to moderate disability have had postoperative phlebo-

TABLE 2. Results of Thrombectomy

Results	Symptoms Less Than 10 Days	Symptoms 14-21 Days
Normal limb	26	1
Slight to mod. disability	5	4
Severe postphlebitic limb	0	1*
Amputation	0	3
Death from thrombosis	0	2
Death unrelated	3	1
Totals	34	11

* Also had amputation.

TABLE 3. Results of Postoperative Phlebography
Symptoms Less Than 10 Days

	No. Patients	Normal Phlebogram	Major Block
Normal limb	26	11	2
Sl. to mod. disability	5	4	1
Totals	31	15	3

15/18 Phlebograms = Normal = 84%.

grams of which two are normal and one shows a major venous occlusion.

In this favorable group, 27 of the 31 living patients have been followed longer than six months. Twenty-six (84%) have apparently normal limbs and five (16%) have slight to moderate disability. Not one patient in this group has a seriously debilitated leg (Table 4).

Eleven patients were operated upon who had symptoms of deep vein thrombosis of 14 to 21 days' duration (Table 1). Patients with symptoms beyond three weeks duration were not considered candidates for thrombectomy. Great technical difficulty in re-establishing blood flow was encountered in this group of patients. The clot was tenaciously adherent to the vein wall in all cases. It could not be removed completely in a single patient. In no patient was satisfactory bidirectional flow reconstituted and in only two was unidirectional flow obtained. In these two cases, the re-established flow was from the iliac end of the venotomy. In five patients no flow at all could be obtained; two died with massive

TABLE 4. Results of Postoperative Phlebography
Symptoms For 14-21 Days

	No. Patients	Normal Phlebogram	Major Block
Normal limb	1	-	-
Sl. to mod. disability	4	-	3
Amputation	3	-	1
Totals	8	0	4

4/4 Phlebogram = Major Block = 100%.

thrombosis of the inferior vena cava; one required an above-knee amputation; one has a severely crippled, postphlebotic limb; the other patient has slight edema but no limitation of the use of his leg.

Six of the 11 patients in this unfavorable group are either dead or have major amputations (Table 4). Four of the remaining five had postoperative phlebograms which showed major obstruction of the deep venous system in every case (Table 3). Only one of the 11 patients in this group has a relatively normal limb and he has some residual edema.

Discussion

At the inception of this clinical study no arbitrary definition for the *acuteness* of an episode of iliofemoral occlusion was made. However, as the experience with thrombectomy accumulated, it became obvious that beyond a certain time period the process of organization of the thrombus inexorably involved the wall of the vein and established a firm bond between the clot and the intima. Ten to 14 days after acute thrombosis it was not possible to remove enough clot to alter the established course of the disease. The one patient who has a nearly normal limb, despite symptoms of 18 days duration, has an apparently adequate collateral circulation. His postoperative phlebogram showed a rich plexus of collateral channels. The attempted thrombectomy did not establish adequate flow in either direction.

The two patients who died of inferior vena cava extension may shed significant light on the potentially lethal pathology of iliofemoral thrombosis. Each of these middle-aged men had true phlegmasia cerulea dolens, the only two examples of this condition in the whole series of 45 patients. An important feature of the history in both patients was the fact that the symptoms began exactly as in the other 43 cases, with a warm, swollen, pale pink, or slightly mottled limb. This condition suddenly

changed to a cold, dark blue, violaceous extremity on the fifteenth day in one case, and on the thirteenth day in the other. Both patients were dead within 48 hours of this dramatic clinical change. The post-mortem findings were similar: complete occlusion of the common, external, and internal iliac veins with extension of the thrombus material into the inferior vena cava in one patient; and thrombosis of the inferior vena cava up to and actually involving one of the renal veins in the other.

It seems likely that the etiology of phlegmasia cerulea dolens is total thrombosis of all venous collateral circulation to an extremity. In phlegmasia alba dolens, or the usual iliofemoral thrombosis, the internal iliac (hypogastric) system is not completely obstructed. This has been documented on a number of preoperative phlebograms. But this internal iliac collateral system is the sole remaining drainage for the deep veins of the leg. If the thrombotic process is propagated into the common iliac vein and thereby occludes this final avenue for egress of venous blood, the arterial flow is likewise stopped and the warm limb suddenly becomes cyanotic and cold. The exact cause of death which results from this condition awaits further study.

The ease with which intact casts of the whole iliofemoral system were removed in the acute cases was both satisfying and terrifying. In many instances, the serpentine clot extruded itself when the venotomy was made. A similar dislodged clot is well-known to the pathologists.

If such extrusion of the clot is frequently encountered, what is the danger of intravascular operative dislodgment and pulmonary embolization? None of the patients has developed symptoms suggestive of embolization. The majority of the patients had chest x-rays before discharge from the hospital. No lesion suggestive of infarction was noted.

The possibility of manipulative fragmentation of clot was a source of grave con-

cern at the beginning of this study, but there has been no evidence that it is a significant hazard under the conditions described above. Great care was taken in all cases to increase the intra-abdominal pressure by a Valsalva maneuver before and during the extraction of the clot. The clot was never disturbed until the patient was fully heparinized.

In only one instance did anticoagulation pose a threat. This occurred in a 22-year-old housewife who developed iliofemoral venous thrombosis in the eighth month of her pregnancy. It was our feeling that the danger of inducing an abortion was far less than the risk of extension of the thrombosis into the pelvic veins, which would certainly complicate both the pregnancy and the delivery. Fortunately, a complete thrombectomy was easily accomplished 36 hours after the onset of her symptoms. She was maintained on oral anticoagulants for four weeks. All anticoagulants were stopped one week before her expected date of delivery. She responded to this regimen by producing a healthy seven-pound boy 12 days later without any bleeding problems. Seventeen months after the thrombectomy, she has a normal leg and is pregnant again!

There is an excellent correlation between apparently normal limbs following thrombectomy and normal phlebograms on one hand, and between seriously debilitated limbs and major occlusion on phlebograms on the other hand. There were serious misgivings about carrying out postoperative phlebograms on normal limbs, but the documentation of continuing patency following thrombectomy seemed imperative in this study. Fortunately, phlebography has proven to be an innocuous procedure.

One of the less dramatic, but equally satisfying effects of thrombectomy was the immediate relief of pain which the patients experienced when the clot was removed. The relief usually occurred on the operating table and was often commented upon

voluntarily by the patients either in the operating room or in the recovery area.

The primary reason for the use of thrombectomy in the treatment of deep venous thrombosis is to prevent the subsequent development of deep venous incompetence with the tragic sequelae of the postphlebotic limb. The crippling effect of postthrombotic venous insufficiency on the young wage earner or young mother has not been fully appreciated. Our data strongly suggest that immediate thrombectomy in the acute stage of iliofemoral thrombosis can be expected to remove practically all of the occluding clot and to re-establish a normal deep venous circulation in the majority of patients.

Summary

Forty-five patients with acute iliofemoral venous thrombosis have been treated by thrombectomy in the University of Louisville Hospitals. Eighty-seven per cent have been followed for longer than six months (average follow-up period = 18.3 months) and of these, 65 per cent have had postoperative phlebograms.

Thirty-four patients had symptoms of occlusion for less than 10 days. Twenty-six of 31 in this favorable group have apparently normal legs and 83 per cent of those tested have normal postoperative phlebograms.

In 11 patients the thrombosis was present for 14 to 21 days before operation. The operative removal of the thrombus was much more difficult in this group and was rarely complete. Only one of these patients has a normal leg. Three patients ultimately required limited amputations and two died from extension of the thrombus into the inferior vena cava.

On the basis of this experience, we believe that immediate thrombectomy is the treatment of choice for acute iliofemoral venous thrombosis. It offers prompt relief of pain, removes the threat of embolization and most importantly, it apparently

prevents the development of deep venous incompetence which so frequently results in a postphlebitic limb.

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DISCUSSION

DR. ROBERT R. LINTON (Brookline, Mass.): I am glad to have been asked to discuss this paper and to have an opportunity to study the manuscript in addition. I have enjoyed Dr. Haller's excellent presentation of one of the disturbing problems in major surgery, and I would like to congratulate him on his excellent results. I am afraid, however, I do not entirely agree with him on all counts.

I am glad to say, in my own experience cases of massive venous thrombosis such as he has described are much fewer now than they were 25 years ago when we started doing femoral interruptions and thrombectomy for femoral iliac thrombosis.

As you probably know, we surgeons at the Massachusetts General Hospital have performed this operative procedure on several thousands of extremities, a sizeable experience. And yet I am glad to say that we have not witnessed the predicted postligation chronic ulcer of the lower extremity to be called "the Massachusetts General Hospital type."

I should like to point out to you, that post-thrombotic ulcers develop because of canalization of a previously thrombosed femoral vein rather than because the femoral vein is occluded or interrupted. Another reason why the interruption is worth while.

There is no question that restoration of the arterial continuity is the ideal method of therapy in arterial occlusive disease, but I am not sure that this is true for thrombotic occlusion of large veins, such as the femoral, iliac, or inferior vena cava because of the danger of recurrent thrombophlebitis and secondary pulmonary embolism. Deep venous thrombosis of the lower extremity is a serious condition because I believe it is the site of origin of most pulmonary emboli and without much question 95 to 98 per cent of fatal pulmonary emboli.

I realize that the post-traumatic extremity with edema and chronic ulceration, the sequelae of deep venous thrombosis in the leg are difficult problems in therapy. However, I am not as fearful of this condition as Dr. Haller because of the success I have had in these cases with surgery

and utilizing the *Linton* type of elastic stocking. It bothers me no end, however, to have a patient sent to me by a family physician because of a swollen leg, and this occurs a number of times each year, following femoral vein interruption performed by some other surgeon six months to a year previously.

When I ask the patient, "When did you last see the surgeon who operated on you?" the invariable answer is "I haven't seen him since he operated upon me."

Gentlemen, this is not good surgery, and I believe it is one of the reasons why femoral vein interruption for thrombo-embolic disease has had a bad name in some areas. I personally insist on making the patients wear the elastic stocking until it may be discarded, and do not let the patient decide this.

I am certainly in whole-hearted agreement, however, with Dr. Haller that thrombectomy is extremely important in the treatment of phlegmasia alba dolens and of utmost importance in the treatment of phlegmasia cerulea dolens, in order to open up the collateral venous channels, especially the large branches of the femoral vein in the femoral triangle, including the profunda femoris. I have found it can be performed extremely easily and leaves the venous endothelium very clean and smooth if done within 48 hours after the leg has become swollen to the groin, which indicates a massive type of femoral iliac thrombosis.

Each succeeding 24 hours, however, results in more adherence of the clot and more difficulty in removing it, as Dr. Haller has suggested. I still believe the best treatment for venous thrombosis of the deep veins of the calf is femoral vein interruption with anti-coagulant therapy for a few days postligation; early ambulation; and later adequate elastic support. Once the venous interruption is accomplished, pulmonary embolism need not be feared in future years if venous thrombosis develops again in the leg. I am disturbed that Dr. Haller has had so many of these extensive venous thromboses to operate upon, which means I think that the doctors, both physicians and surgeons in his community need education in the prophylaxis and early diagnosis of deep venous thrombosis.

I am sure that prevention of venous thrombosis